

***Monitoring
Chemicals of Emerging Concern (CECs)
in California's Receiving Waters***

Keith Maruya

Southern California Coastal Water Research Project

Daniel Schlenk

University of California, Riverside

State Water Resources Control Board

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ORIGIN OF THE ECOSYSTEMS PANEL

- **Regulatory requirements need to be based on the best available peer-reviewed science**
- **State of knowledge regarding CECs is incomplete**
- **Advisory panel needed to guide future actions statewide relating to CECs in**
 - recycled water (original Panel convened in 2009)
 - aquatic ecosystems (this effort)
- **Respond to questions most relevant to SWRCB mission**

PANEL SELECTION PROCESS

- **SCCWRP enlisted a Stakeholder Advisory Group to guide panel member selection**
- **All members of Recycled Water Panel retained**
- **Expertise in marine resources/antibiotic resistance added**
- **Ecosystems Panel convened in January 2010**

PROCESS and PHILOSOPHY

- **Open and transparent process**
 - Panel member selection
 - Meeting agendas and information exchange
 - Comments and feedback
- **Stakeholder advisory group with diverse interests**
 - Public interest groups
 - Wastewater dischargers and storm water permittees
 - State regulatory and resource agencies
- **Public commentary and panel report - at each meeting**
- **Recommendations to be science-based**

STAKEHOLDER ADVISORS

- **Jim Colston (Tri-TAC)**
- **Chris Crompton (CA Storm Water Quality Association)**
- **Mark Gold (Heal the Bay)**
- **Amber Mace (CA Ocean Science Trust)**
- **Rick Moss* (SWRCB)**
- **Linda Sheehan (CA Coastkeeper Alliance)**

* succeeded by G. Dickenson and M. Emanuel

PANEL MEMBERS

- **Dr. Paul Anderson**
 - Human Health Toxicologist
 - Arcadis US
- **Dr. Nancy Denslow**
 - Biochemist
 - University of Florida
- **Dr. Jörg Drewes**
 - Civil Engineer
 - Colorado School of Mines
- **Dr. Adam Olivieri**
 - Risk Assessor
 - EOA Incorporated
- **Dr. Daniel Schlenk (Chair)**
 - Environmental Toxicologist
 - UC Riverside
- **Dr. Shane Snyder**
 - Analytical Chemist
 - University of Arizona
- **Dr. Geoff Scott**
 - Marine Resources
 - NOAA

MONITORING IS CRITICAL TO PROTECTING BENEFICIAL USES

- **We know CECs are out there, but...**
 - We lack the means to measure most of them, and
 - We are just beginning to understand their potential impacts, so
 - We cannot assess their impact fast enough, or with great certainty
- **What can we do today?**
 - Nothing
 - Ban all CECs
 - Measure everything humanly possible
 - ***Use the best available science to develop a monitoring strategy to identify CECs that have the highest chance of causing damage***

HOW DO WE MONITOR FOR CECs?

- What are the relative contributions from storm water and WWTP effluent?
- What are the appropriate CECs to be monitored, including analytical methods and detection limits?
- What is the fate of CECs in WWTPs, storm, and receiving waters?
- What approaches should be used to assess biological effects?
- What is the appropriate monitoring design?
- What levels of CECs should trigger additional action? What range of actions should be considered?

SCHEDULE

- **Jan 2010: Kickoff meeting**
 - State of science
 - Stakeholder perspectives
- **Sep 2010 – Jan 2012: Four working meetings**
- **Feb 2012: Draft Recommendations released for public comment**
- **Mar 2012: Final meeting**
 - Panel response to public comments on draft report
- **Apr 2012: Final Report submitted to SWRCB staff**
- **Sep 2012: Staff recommendations released**

PANEL DELIVERED FOUR PRODUCTS

- **Decision making “risk-based” framework**
 - A tool to prioritize CECs now and into the future
- **Application of framework to discharge scenarios of interest**
 - Initial list of CECs to monitor in water, sediment, biota
- **Monitoring recommendations and interpretation**
 - How, where and when to monitor; how to respond to results
 - A process that can adapt to changing science and chemical use
- **Future recommended activities**
 - Develop better monitoring tools to improve and refine the process

RISK-BASED SCREENING FRAMEWORK

- **Step 1: Measure or predict occurrence (MEC or PEC)**
 - Provided through investigative monitoring (e.g. regional, special studies)
- **Step 2: Determine concentration that is protective of resource (aka “monitoring trigger level” or MTL)**
 - Published information on no/low observable effects concentrations
- **Step 3: Calculate “Monitoring Trigger Quotient” (MTQ)**
= MEC (or PEC) / MTL
 - If $MTQ < 1$, no concern
 - If $MTQ > 1$, add to candidate list

DISCHARGE SCENARIOS

- ***Effluent dominated inland waterway***
 - Low flow (dry weather) conditions
 - No dilution of WWTP effluent
- ***Coastal embayment***
 - WWTP effluent and storm water discharge
 - 10 fold dilution of source input
- ***Offshore ocean discharge***
 - Large WWTP outfalls in deeper water
 - 100 fold dilution of WWTP effluent

HOW THE FRAMEWORK WAS APPLIED

- **Panel considered chemicals for which both occurrence and toxicity data was available**
 - Priority on those with known low level effects and occurrence in CA systems
- **Panel considered both effluent and receiving water monitoring data**
 - Maximum concentrations to be conservative
- **Panel focused on non-traditional effects**
 - Many CECs are suspected “endocrine disrupters” at sub-lethal concentrations
- **Robust analytical methods must be available**
 - Survey of commercial services industry

CECs IN WATER*

- **Pesticides**
 - bifenthrin, permethrin, chlorpyrifos
- **Consumer products**
 - bisphenol A, diclofenac, galaxolide, ibuprofen
- **Natural hormones**
 - 17b-estradiol, estrone
- **Antibiotics**
 - triclosan (river scenario only)
- * River and Bay scenarios only

CECs IN SEDIMENT AND TISSUE

- **Sediments (Bay and Ocean Scenarios)**
 - Plasticizers (bis-2-ethylhexyl, butylbenzyl phthalates)
 - Flame retardants (PBDE-47, -99)
 - Detergents (4-nonylphenol)
 - Pyrethroids (bifenthrin, permethrin) – Bays only
- **Biological tissue (All Scenarios)**
 - Polybrominated diphenyl ethers (PBDEs)
 - Perfluorinated chemicals (e.g. PFOS)

ADAPTIVE MONITORING STRATEGY INCLUDES “OFF-RAMPS...”

Monitoring Trigger Quotient (MTQ)

High concern – Control (all controllable) sources

Elevated concern – Confirm levels; expand monitoring (ID sources); refine risk assessment; control (easy) sources

Moderate concern – Continue monitoring to ensure concentrations are not increasing

Little/No concern – Discontinue monitoring

...AND “ON-RAMPS”

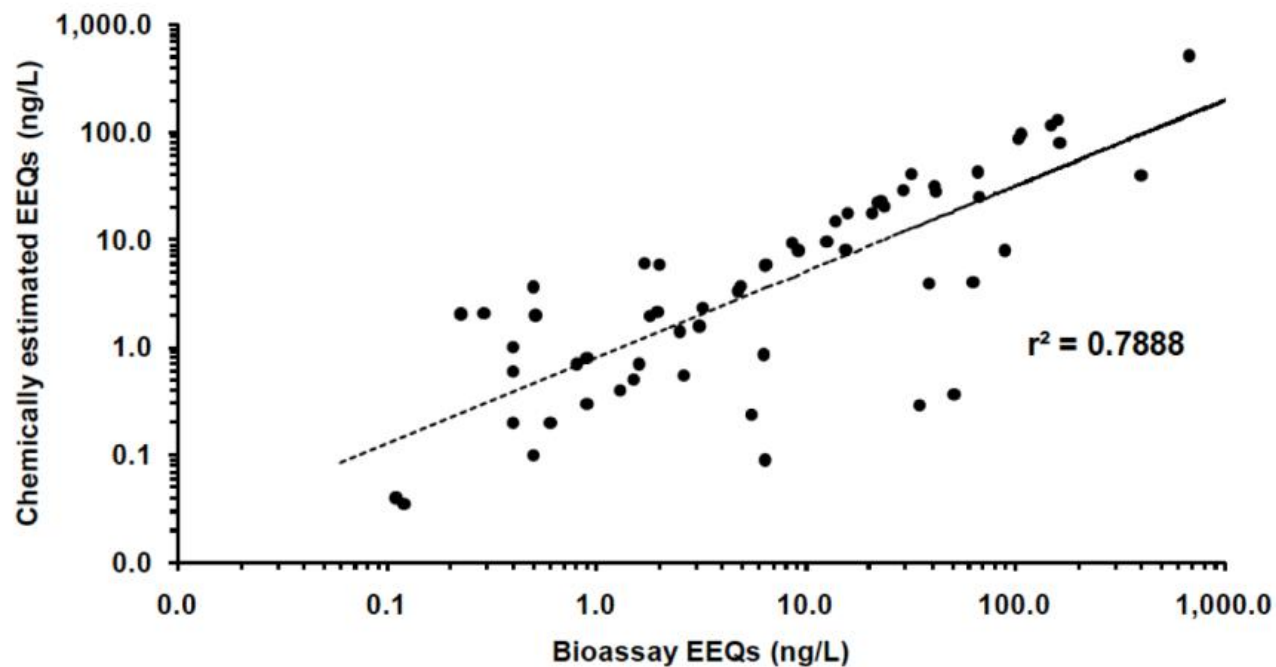
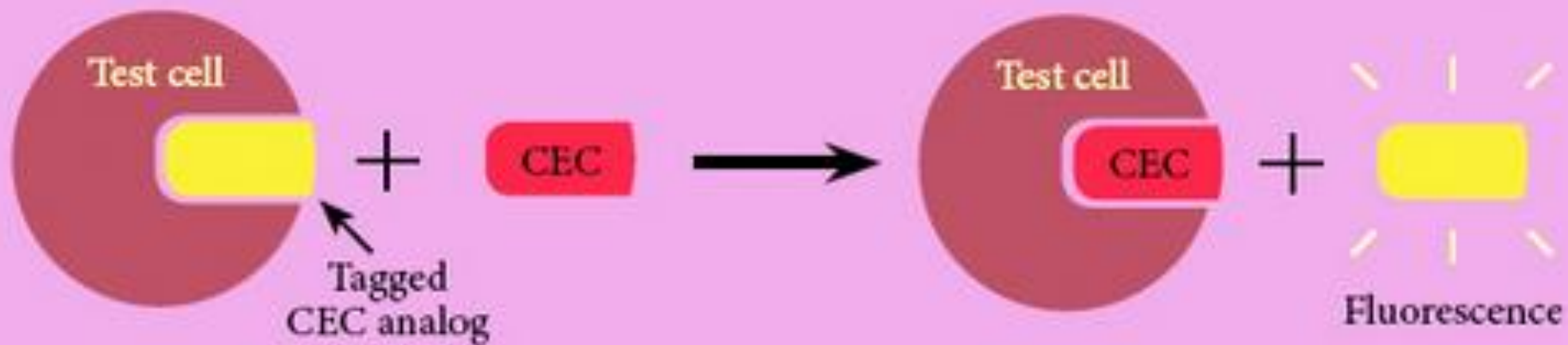
- **Panel recommended investigative monitoring and special studies for “data poor” CECs**
 - Newly developed and/or registered drugs, pesticides, and flame retardants
- **Panel recommended development of modeling tools to pre-screen for problematic CECs**
 - Consider production, usage, fate and potential for toxicity
- **Use Panel’s assessment framework to determine if CECs warrant inclusion in future monitoring (“On-Ramp”)**
- **Incorporate new information and revisit recommendations every 3-5 years**
 - Infuse the latest science and update CEC lists and tools

DEVELOP BIOLOGICAL SCREENING TOOLS

- **Targets impact to resources**
 - More relevant than simple exposure
 - Different types of damage are targeted
- **Greater efficiency**
 - Less time and money than exhaustively analyzing countless chemicals
 - Works for priority pollutants and CECs
- ***In vitro* bioassays to screen for CECs in recycled water**
 - Commercially available technology
 - SWRCB Contract 10-096-250
 - Results due in 2014



HOW *IN VITRO* BIOASSAYS WORK



CONCLUDING REMARKS

- **The Panel looks forward to working with staff and stakeholders in crafting a comprehensive CEC monitoring strategy for receiving waters throughout the state**
- **The Panel enjoyed the process and interactions and is happy to serve the state in future assessments**
- **The Panel thanks the Board for the opportunity to infuse science into the process**